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16367 U.S.PTO

PROVISIONAL PATENT APPLICATION UNDER §111(b)	*Attorney Docket No.*	091395-9429
	First Named Inventor	Richard F. Murphy
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030304

Mail Stop PROVISIONAL PATENT APPLICATION
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Sir:

Enclosed for filing is a complete provisional patent application entitled "SWITCHING FINGER FOLLOWER ASSEMBLY" invented by:

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and including the following documents:

Specification including Claim - 6 pages
Abstract of the Disclosure
Drawings - 4 sheets
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cc: Docketing
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SWITCHING FINGER FOLLOWER ASSEMBLY

BACKGROUND

[0001] The present invention relates to mechanisms for altering the actuation of valves in internal combustion engines; more particularly, to finger follower type rocker arms having means for changing between high and low or no valve lifts.

[0002] Variable valve activation (VVA) mechanisms for internal combustion engines are well known. It is known to be desirable to lower the lift, or even to provide no lift at all, of one or more valves of a multiple-cylinder engine, especially intake valves, during periods of light engine load. Such deactivation can substantially improve fuel efficiency.

SUMMARY

[0003] The present invention provides a finger follower rocker arm assembly for variably activating a gas valve in an internal combustion engine having a camshaft having a central lobe and at least one lateral lobe. The rocker arm assembly comprises a follower body having means for engaging the engine at a first end of the body and having means for engaging a valve stem of the gas valve at a second end of the body and having a passage formed in the body between the first and second ends. A cam follower is rotatably supported in the passage and has an outer surface for engaging the central lobe of the camshaft. At least one lateral slider follower is supported on and selectively rotatable relative to the follower body. The at least one slider follower engages the at least one lateral lobe of the camshaft. Locking means are associated with the follower body for selectively engaging the at least one slider follower. When the locking means engages the at least one slider follower, the slider follower is prevented from rotating relative to the follower body such that contact of the at least one lateral lobe transmits a rotational force to the follower body. When the locking means is free from engagement with the at least one slider follower, the at least one slider follower is free to rotate relative to the follower body such that contact of the at least one lateral lobe causes rotation of the at least one slider follower relative to the follower body and rotational force to the follower body is provided by contact of the central lobe with the cam follower.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] Fig. 1 is an isometric view of a preferred embodiment of the present invention installed schematically in an internal combustion engine.

[0005] Fig. 2 is an exploded isometric view of the preferred embodiment of the present invention.

[0006] Fig. 3 is an isometric view of the preferred embodiment of the present invention with the locking pin in an unlocked position.

[0007] Fig. 4 is a cross sectional view of the rocker arm assembly as it is shown in Fig. 3.

[0008] Fig. 5 is an isometric view of the preferred embodiment of the present invention with the locking pin in a locked position.

[0009] Fig. 6 is a cross sectional view of the rocker arm assembly as it is shown in Fig. 5.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010] The present invention will be described with reference to the accompanying drawing figures wherein like numbers represent like elements throughout. Certain terminology, for example, "top", "bottom", "right", "left", "front", "frontward", "forward", "back", "rear" and "rearward", is used in the following description for relative descriptive clarity only and is not intended to be limiting.

[0011] Referring to FIGS. 1-6, a switching finger follower rocker arm assembly 10 in accordance with a first embodiment of the invention is shown. The rocker arm assembly 10 includes a follower body 12 having a first end 14 having means for receiving the head of a hydraulic lash adjuster 16 for pivotally mounting assembly 10 in an engine (not shown). The receiving means is preferably a spherical socket 20, as shown in FIGS. 3-6. An opposite end 22 of follower body 12 is provided with a pad 24, preferably arcuate, for interfacing with and actuating a valve stem 26 of gas valve 27. The rocker arm assembly 10 is aligned with a camshaft 100 having multiple cam lobes 102, 104 and 106, as will be described hereinafter.

[0012] The follower body 12 is provided with a passage 28 therethrough between socket 20 and pad 24, passage 28 being generally configured to receive a cam follower 32. Body 12 is further provided with a first bore 34 transverse of passage 28 for supporting a shaft 40 extending through bore 34 and a central bore 33 in the cam follower 32 to support the cam follower 32 in passage 28 for rotation about the shaft 40 axis X. The central bore 33 is preferably provided with a roller bearing assembly (not shown) to facilitate rotation about the shaft 40, but may otherwise be configured for rotation.

[0013] First and second lateral slider followers 42a,b are mounted on opposite ends, respectively, of shaft 40 such that the slider followers 42a,b are supported for rotational motion

about the shaft 40 axis X. Each slider follower 42a,b has an arcuate outer surface 44 for engaging an outer cam lobe 104, 106 of the engine camshaft 100, as will be described hereinafter. The arcuate outer surfaces 44 are such that the center of the curve is located offset from the shaft 40 axis X such that a rotating force is created on the slider followers 42a,b when a force is applied by the cam lobes 104, 106.

[0014] On an opposite lower surface 43, each slider follower 42a,b is provided with a retaining notch 45 configured to receive an end of a spring member 60. Referring to Figs. 1-2, 4 and 6, the spring member 60 is configured such that a first end 62 positioned in the retaining notch 45 of one of the slider followers 42a. The spring member 60 extends from the end 62 and coils about and is retained in a circumferential groove 41 of the shaft 40. The spring member 60 has a bridging portion 64 that extends across the first end 14 of the follower body 12. The spring member 60 coils about and is retained in a circumferential groove 41 on the opposite end of the shaft 40. With the spring member 60 retained in both grooves 41, the spring member 60 secures the slider followers 42a,b on the shaft 40 and unitizes the assembly. The spring member 60 has a second end 66 that terminates and is retained in the retaining notch 45 on the other slider follower 42b. The spring member 60 thereby biases both slider followers 42a,b in an upward arc about the axis X to an upper, cam lobe engaging position. As shown in Figs. 4 and 6, in the upper, cam lobe engaging position, the arcuate outer surface 44 of each slider follower 42a,b extends higher than the outer surface of the cam follower 32.

[0015] Each slider follower 42a,b is also provided with a locking notch 48 along an end of the slider 42 proximate the first end 14 of the follower body 12. Each locking notch 48 includes a flat engagement surface 49 configured for selective engagement by a flat engagement surface 55 of a locking pin 50 extending through the follower body 12. Referring to Figs. 2-6, the locking pin 50 has a central body 52 that is positioned through and rotationally supported in second bores 35 extending through the body 12 transverse to the passage 28. The ends 54, 56 of the locking pin 50 extend outward of the follower body 12. Each end 54, 56 has a generally semicircular configuration to define a respective flat engagement surface 55.

[0016] As shown in Fig. 3, in a first, unlocked position, the locking pin ends 54, 56 are clear of the locking notch 48. The slider followers 42a,b are thereby free to rotate about axis X upon contact by the cam lobes 104, 106. As such, in this unlocked condition, the slider followers 42a,b do not exert a rotational force on the follower body 12, but instead rotate freely and independently of the follower body 12.

[0017] Referring to Fig. 5, upon rotation of the locking pin 50, each locking pin end 54, 56 is rotated to a second, locked position wherein the end 54, 56 is received in a respective one of the locking notches 48. Each locking pin engagement surface 55 contacts a respective locking notch engagement surface 49, thereby preventing rotation of the slider followers 42a,b about the axis X. As such, the force of the cam lobes 104, 106 will be directed through the locked slider followers 42a,b to the follower body 12, causing the follower body 12 to rotate and providing a high lift to the valve stem 26. In the preferred embodiment, the notch engagement surfaces 49 contact the locking pin engagement surfaces 55 beyond the axis Y of the locking pin 50 so that the contact force passes through the axis Y and does not provide as great of a rotational force on the locking pin 50 in an unlocking direction.

[0018] The locking pin 50 is preferably rotated between the unlocked position and the locked position by a hydraulic actuator 70, however, the locking pin 50 may be rotated by other mechanical or electromechanical means, for example, an electric solenoid actuator. The hydraulic actuator 70 will be described with reference to Figs. 2, 4 and 6. The hydraulic actuator 70 has a body 72 configured to be positioned between the walls 13, 15 of the follower body 12 adjacent the first end 14. The body 72 preferably has a head 74 to limit axial movement of the body 72 relative to the follower body 12. The bridge portion 64 of the spring member 60 extends over the actuator body 72 to retain the actuator body 72 within the side walls 13, 15.

[0019] The actuator body 72 has an internal bore 76 configured to receive and support a piston member 78 having a piston head 80 and a piston shaft 82. The piston head 80 seals against the inside surface of the bore 76 such that the bore 76 and the piston head 80 define a fluid chamber 77. A fluid passage 79 extends from an external surface of the actuator body 72 to the fluid chamber 77. A fluid channel 90 extends from the lash socket 20 and is in sealed communication with the fluid passage 79 such that a sealed fluid path is formed between the lash socket 20 and the fluid chamber 77. As fluid pressure passing through the lash adjuster 16 increases, the pressure in the fluid chamber 77 increases and causes the piston member 78 to move toward the locking pin 50. The amount of fluid pressure passing through the lash adjuster 16 may be controlled in various manners, for example, through command from an engine control module (not shown).

[0020] Referring to Figs. 4 and 6, the locking pin central body 52 has a cutout portion 51 that defines a generally flat surface 53 in alignment with the piston shaft 82. With the piston member 78 retracted, the piston shaft 82 is clear of the flat surface 53 and the locking pin 50 is free to rotate to the unlocked position as shown in Figs. 3 and 4. As the piston member 78 is extended,

the piston shaft 82 contacts the flat surface 53 and thereby rotates the locking pin 50 to the locked position as shown in Figs. 5 and 6. A spring or the like (not shown) may be provided about the piston shaft 82 to bias the piston member 78 to the unlocked position.

[0021] Having described the components of the preferred finger follower assembly 10, its operation will now be described with reference to Figs. 1-6. Referring to Fig. 1, the camshaft 100 includes a central cam lobe 102 that is aligned with the cam follower 32. The central cam lobe 102 is flanked by first and second lateral cam lobes 104, 106 for selectively engaging the slide followers 42a,b, respectively.

[0022] When the engine is operating in a low oil pressure mode, such that a low-lift condition is desired, the oil pressure passing through the latch socket 20 will be low, thereby maintaining the piston member 78 in a retracted position. As shown in Figs. 3 and 4, with the piston member 78 in the retracted position, the locking pin 50 is rotated to the unlocked position, with the locking pin ends 54, 56 clear of the slider follower locking notches 48. In this unlocked condition, as the camshaft 100 rotates and the lateral cam lobes 104, 106 contact the respective slider followers 42a,b, the slider followers 42a,b simply rotate about the shaft 40 axis X and do not impart any force upon the follower body 12. At the same time, rotation of the camshaft 100 causes the central cam lobe 102 to contact the cam follower 32. Since the cam follower 32 is supported by the follower body 12 via shaft 40, the force of the central cam lobe 102 will be transmitted to the follower body 12, resulting in low-lift actuation of the valve stem 26.

[0023] When the engine is operating in a higher oil pressure mode, such that a high-lift condition is desired, the oil pressure passing through the latch socket 20 increases and causes the piston member 78 to move to the extended position. As shown in Figs. 5 and 6, with the piston member 78 in the extended position, the piston shaft 82 contacts the locking pin flat surface 53 and rotates the locking pin 50 to the locked position, with the locking pin ends 54, 56 extending in to the slider follower locking notches 48. The locking pin engagement surfaces 55 contact the locking notch engagement surfaces 49, thereby locking the slider followers 42a,b against rotation. In this locked condition, as the camshaft 100 rotates and the lateral cam lobes 104, 106 contact the respective slider followers 42a,b, the slider followers 42a,b can not rotate about the shaft 40 axis X, but instead the force of the lateral cam lobes 104, 106 is transmitted through the slide followers 42a,b to the follower body 12, resulting in high-lift actuation of the valve stem 26. The central cam lobe 102 will also be rotating, but will be spaced from and therefore not contact the cam follower 32.

* * *

What is claimed is:

1. A finger follower rocker arm assembly for variably activating a gas valve in an internal combustion engine having a camshaft having a central lobe and at least one lateral lobe, comprising:

a follower body having means for engaging the engine at a first end of the body and having means for engaging a valve stem of the gas valve at a second end of the body and having a passage formed in the body between the first and second ends;

a cam follower rotatably supported in the passage and having an outer surface for engaging the central lobe of the camshaft;

at least one lateral slider follower, supported on and selectively rotatable relative to the follower body, for engaging the at least one lateral lobe of the camshaft; and

locking means associated with the follower body for selectively engaging the at least one slider follower such that when the locking means engages the at least one slider follower, the slider follower is prevented from rotating relative to the follower body such that contact of the at least one lateral lobe transmits a rotational force to the follower body and when the locking means is free from engagement with the at least one slider follower, the at least one slider follower is free to rotate relative to the follower body such that contact of the at least one lateral lobe causes rotation of the at least one slider follower relative to the follower body and rotational force to the follower body is provided by contact of the central lobe with the cam follower.

ABSTRACT

[0024] A finger follower rocker arm assembly for variably activating a gas valve in an internal combustion engine. The rocker arm assembly comprises a follower body having a passage formed in the body between first and second ends thereof. A cam follower is rotatably supported in the passage and has an outer surface for engaging a central lobe of the camshaft. At least one lateral slider follower is supported on and selectively rotatable relative to the follower body. Locking means are associated with the follower body for selectively engaging the at least one slider follower, wherein engagement prevents the slider follower from rotating relative to the follower body such that contact of the at least one lateral lobe transmits a rotational force to the follower body and disengagement allows the slider follower to rotate relative to the follower body such that contact of the at least one lateral lobe causes rotation of the at least one slider follower relative to the follower body and rotational force to the follower body is provided by contact of the central lobe with the cam follower.

Fig. 1

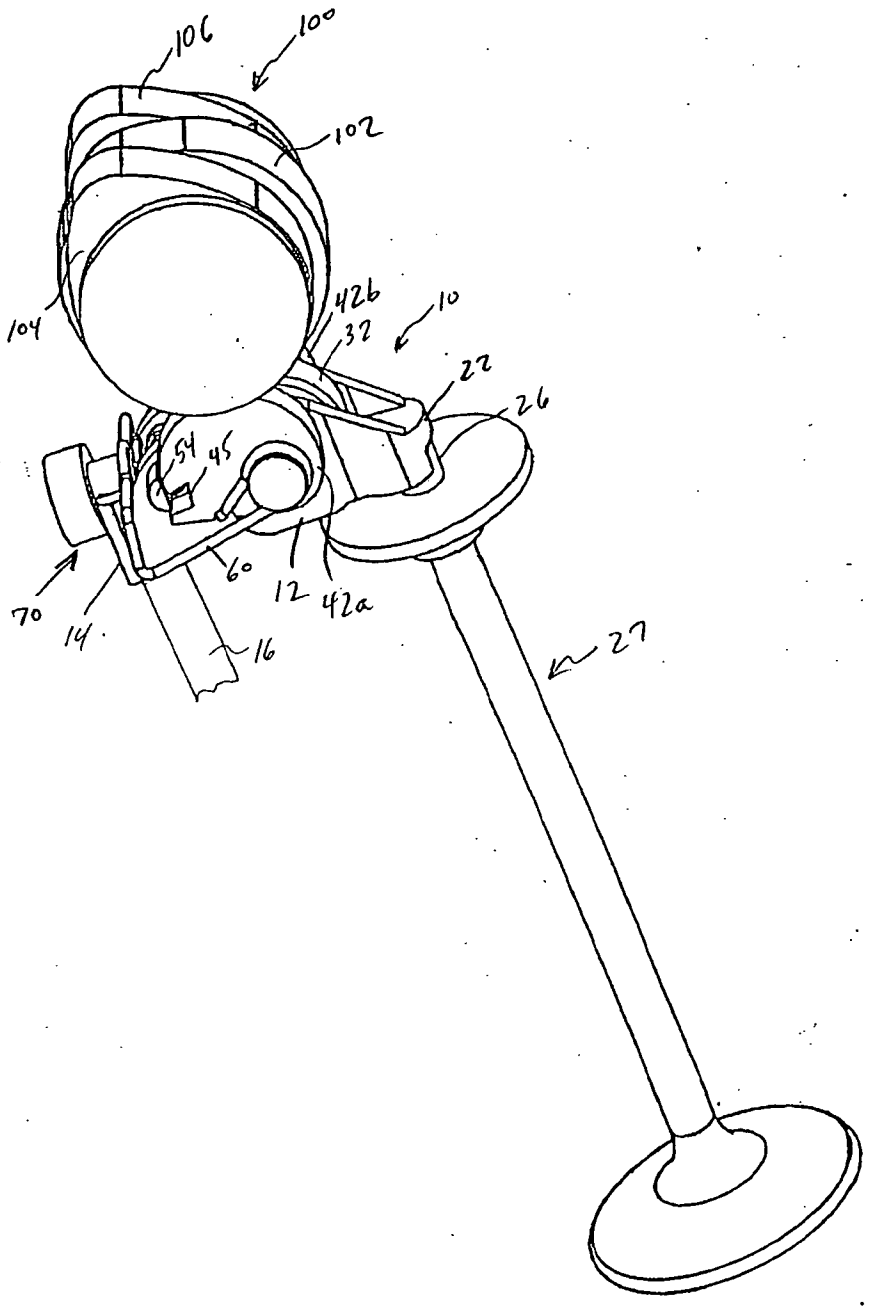

Fig. 2

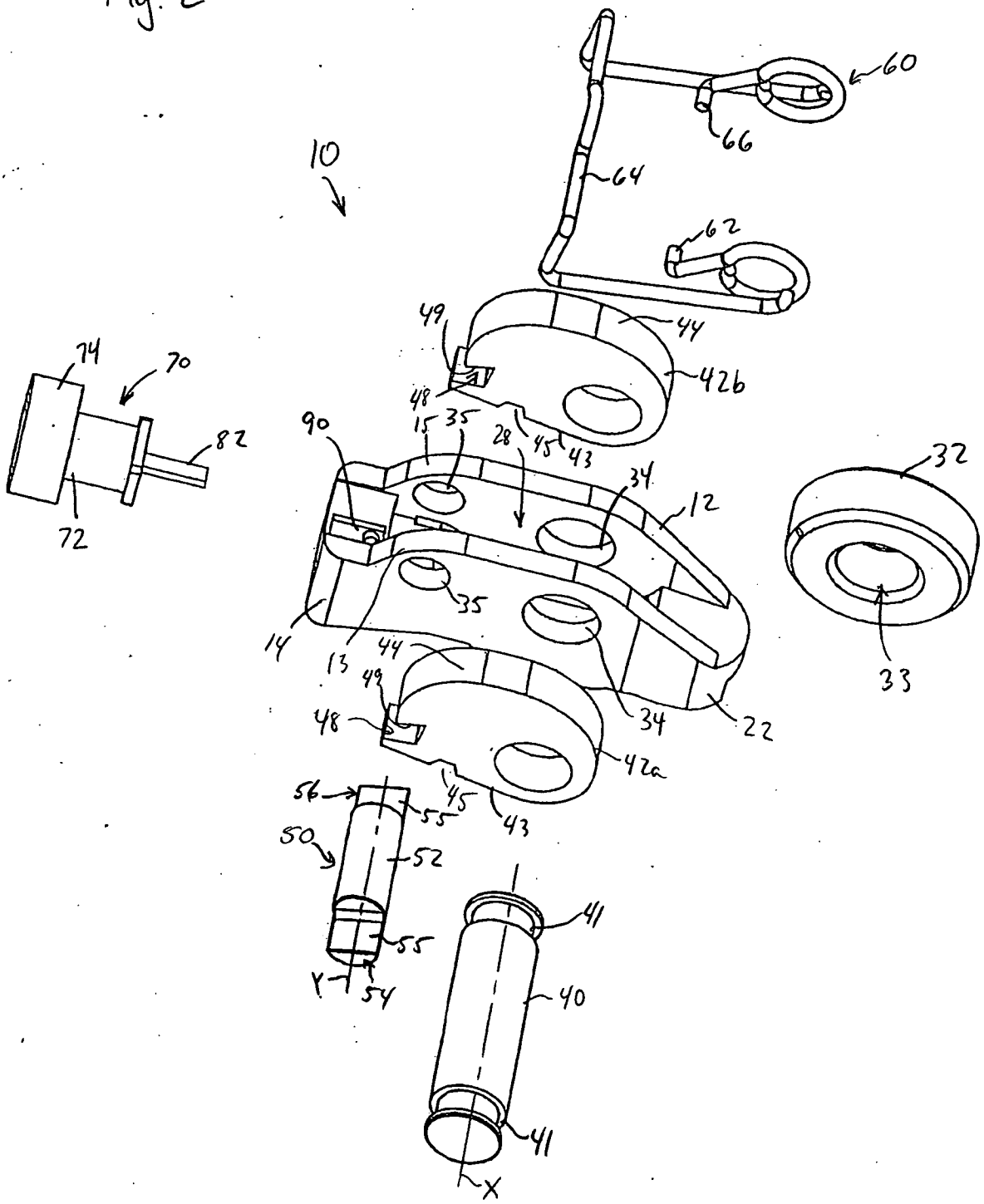
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Fig. 3

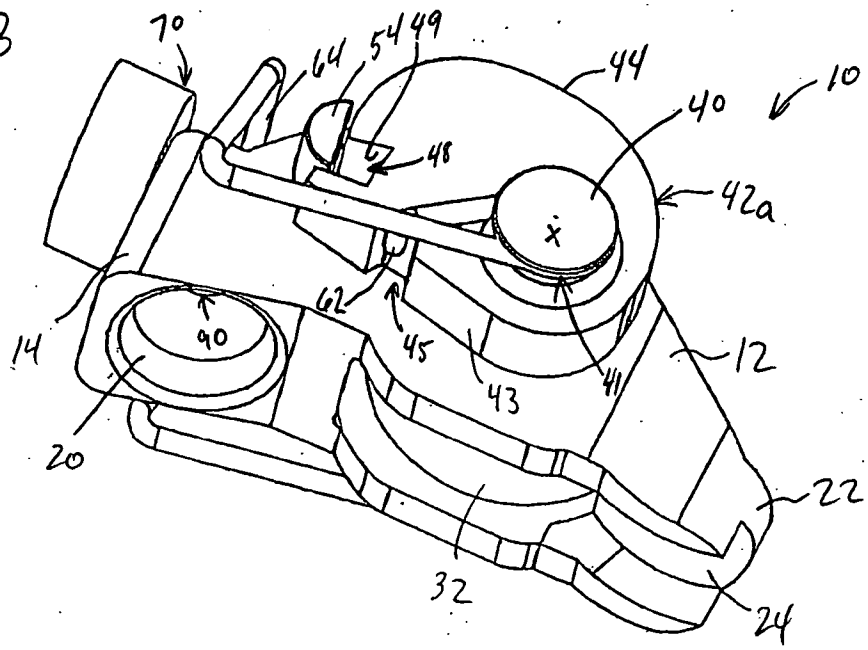
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Fig. 4

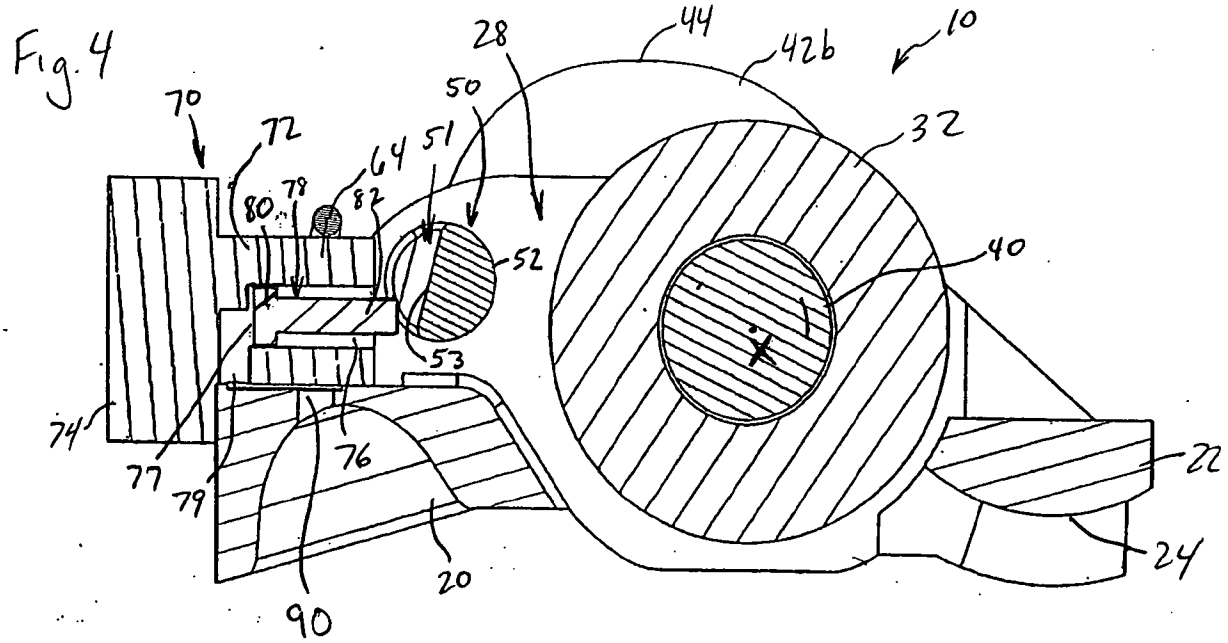
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Fig. 5

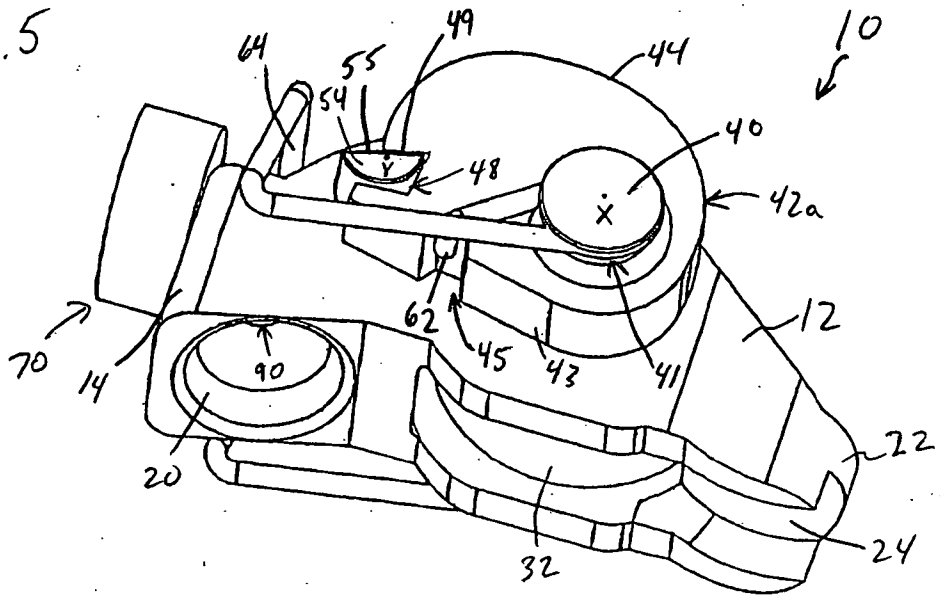
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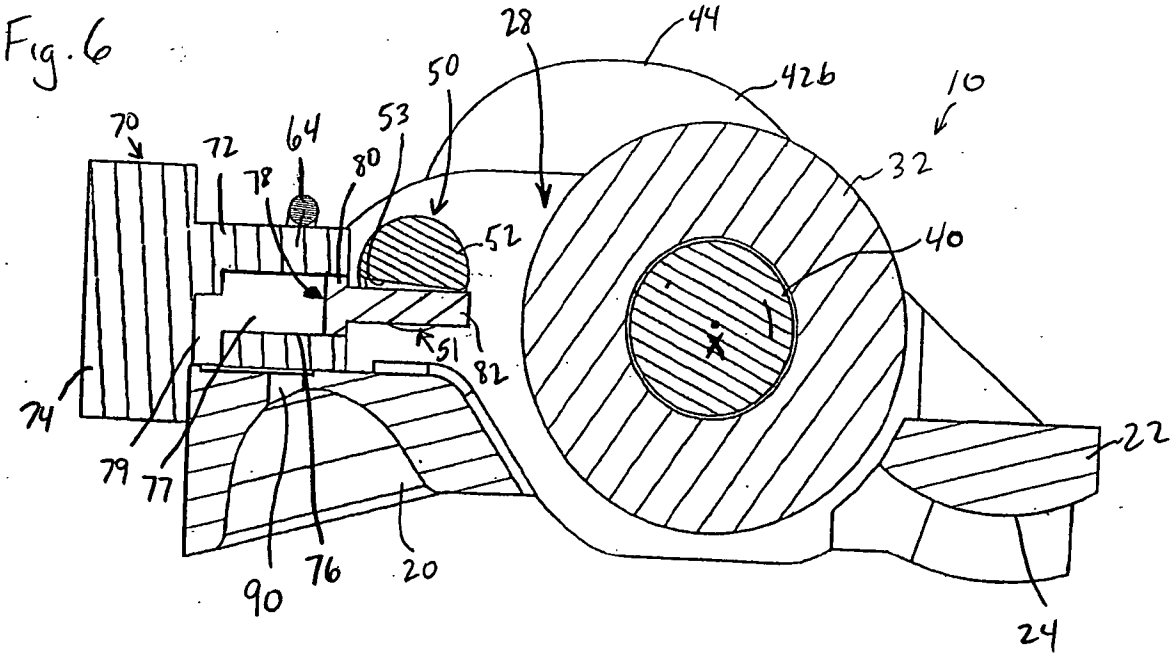
Fig. 6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